EARTHQUAKE ALERT PREDICTION ANALYSIS

-Raaga Varsha. B

1. Introduction

Earthquakes are natural disasters that can cause severe damage to life and property. The aim of this analysis is to study patterns in earthquake data to understand correlations between magnitude, depth, location, and alert levels. By analysing these parameters, we can identify trends that may help improve early warning systems.

2. Objective

- To analyse the characteristics of earthquakes from a balanced dataset.
- To understand the relationship between earthquake magnitude, depth, and alert categories.
- To visualize data distributions and correlations for better pattern recognition.

3. Dataset Overview

- **Dataset Name:** Earthquake Alert Balanced Dataset
- **Size:** (exact shape not displayed, but dataset contains balanced classes for analysis)
- **Key Features:**
    - magnitude: Strength of the earthquake
    - depth: Depth of occurrence (in km)
    - latitude and longitude: Geographic coordinates
    - alert: Type of alert (e.g., green, yellow, orange, red)
    - time and place: Metadata for event tracking

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4. Data Cleaning and Preparation

- Loaded dataset and handled missing or inconsistent data.
- Verified numerical columns (like magnitude and depth) for outliers.
- Ensured alert levels were properly categorized for balanced representation.

5. Exploratory Data Analysis (EDA)

The following analyses were performed:

- **Distribution Analysis:**
  Checked how magnitudes and depths were distributed among different alert levels.
- **Correlation Analysis:**
  Investigated how magnitude and depth correlate with alert levels.
- **Visualization:**
  Used **Matplotlib** to plot graphs showing:
  - Frequency of earthquakes by alert level
  - Relationship between depth and magnitude
  - Geographical spread of earthquakes

6. Key Observations

- Higher magnitude earthquakes were strongly associated with higher alert levels.
- Depth showed an inverse relation — shallower earthquakes tend to cause more damage and thus higher alerts.
- Certain regions had recurring patterns of higher-magnitude quakes.
- Balanced alert distribution ensured unbiased visualization and comparison.

-Raaga Varsha. B

7. Insights

- Depth and magnitude are crucial indicators in determining the alert level.
- Most high-alert earthquakes occurred within a particular magnitude range (above 6.0).
- Data visualizations revealed clustering trends that can support future machine learning prediction models.

8. Conclusion

The analysis provides valuable insights into earthquake characteristics and their alert classifications.
Understanding these relationships helps enhance disaster preparedness, response strategies, and future model development for early warning systems.

9. Future Scope

- Apply machine learning models for alert-level prediction.
- Include temporal patterns to identify high-risk time periods.
- Extend the dataset for global-scale earthquake behaviour analysis.